A Database for Pacific Herring Tagged and Recovered in British Columbia from 1999 to 2006 Using Coded Wire Tag Technology

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ABSTRACT

Flostrand, L., Schweigert, J.F., and Daniel, K. 2007. A database for Pacific herring tagged and recovered in British Columbia from 1999 to 2006 using coded wire tag technology. Can. Manuscr. Rep. Fish. Aquat. Sci. 2832: v + 28 p.

A Pacific herring tagging study using coded wire tags was conducted from 1999 to 2006 through a partnership between the Department of Fisheries and Oceans Canada and the Herring Conservation and Research Society. Samples of tagged fish were released during the 1999 to 2004 spawning seasons and tagged fish were recovered from the 2000 to 2006 roe herring fisheries by searching sub-samples of the roe herring landings. The aim of the study was to collect information to investigate trends in inter-annual spawning ground utilization and migration intensity. This paper describes the tag release and recovery sampling components of the study and the organization of the tagging study records. Tagging study records are currently stored and maintained in a Microsoft ® Access 2002 database file by Department of Fisheries and Oceans, Marine Ecosystem and Aquaculture Division research staff at the Pacific Biological Station, Nanaimo, British Columbia.

RÉSUMÉ

Flostrand, L., Schweigert, J.F., and Daniel, K. 2007. A database for Pacific herring tagged and recovered in British Columbia from 1999 to 2006 using coded wire tag technology. Can. Manuscr. Rep. Fish. Aquat. Sci. 2832: v + 28 p.

Une étude de marquage du hareng du Pacifique au monyen de fil codé a été menée de 1999 à 2006 grâce à un partenariat entre le ministère des Pêches et des Océans du Canada et la Herring Conservation and Research Society. Des échantillons de poissons marqués ont été relâchés durant les saisons de frai 1999 à 2004, et les poissons marqués ont été repêchés pendant les saisons de pêche du hareng rogué 2000 à 2006. La récupération des spécimens marqués s'est faite au moyen de fouilles parmi des sous-échantillons des débarquements de hareng rogué. L'objectif de l'étude était de recueillir des renseignements pour analyser les tendances de l'utilisation inter-annuelle des frayères et l'intensité de la migration. Cette étude décrit les étapes de relâchement des poissons marqués et d'échantillonnage des spécimens récupérés ainsi que l'organisation des dossiers d'étude de marquage. Ces dossiers sont actuellement entreposés et gérés dans une base de données Microsoft ® Access 2002, tenue par le ministère des Pêches et Océans, plus précisément le personnel de recherche de la Division des écosystèmes marins et de l'aquaculture de la Station biologique du Pacifique, à Nanaimo (Colombie-Britannique).

INTRODUCTION

Pacific herring were tagged and released in British Columbia (BC) using coded wire tag (CWT) technology to investigate trends in inter-annual spawning ground utilization and migration intensity. Herring tagging was conducted from 1999 to 2004 and tag recovery catch sampling was conducted from 2000 to 2006. The purpose of this report is to document and describe data records pertaining to the Pacific herring coded wire tagging study. Summaries of the annual CWT releases and tag recovery sampling intensities have also been published in Fisheries and Ocean Canada (DFO) technical reports (Schweigert and Flostrand 2000; Flostrand and Schweigert 2007a, 2007b, 2005, 2004, 2003, 2002). Comprehensive documentation of data records from previous Pacific herring tagging studies (using belly and anchor tags) is reported in Daniel et al. (1999).

For Pacific herring management and stock assessment purposes, there are five stock assessment regions, numerous area subdivisions, and several subdivisions within each area referred to as herring sections (Midgley 2003). Pacific Fishery Management Area Regulations of the Canadian Fisheries Act identify 30 statistical (or management) areas along the BC coast. The five Pacific herring stock assessment regions are comprised of the Queen Charlotte Islands (QCI), the Prince Rupert District (PRD), the Central Coast (CC), the Strait of Georgia (SOG), and the west coast of Vancouver Island (WCVI). Releases from Area 2E were grouped in the QCI; releases from Areas 3 to 5 were grouped in the PRD; releases from Areas 6 to 9 were grouped in the CC; releases from Areas 14, 16 and 17 were grouped in the SOG, and releases from Areas 23 to 26 were grouped in the WCVI. Although sampling intensity varied by year and location, at least one release and one recovery sample was obtained from each of the five herring stock assessment regions over the course of the study period.

Data records in the CWT database came from three main sources. One source was the charter vessel field tagging research trips, where detailed information on fishing conditions, tagging methods, and tag and release sampling intensities was collected. A second source of records was from dockside catch validation efforts, where detailed information on roe herring catch and vessel offloading records was collected. The third source was through CWT recovery sampling at the three fish plants, where detailed information on processing activities, sampling intensities and tag recoveries was collected.

DESIGN OF TAGGING PROGRAM

TAGGING AND RELEASING HERRING

Sexually mature herring were caught, tagged and released in BC inshore waters from 1999 to 2004 using several different vessels. Each year, a vessel and crew were commissioned to support tagging operations for a 30 day period starting and ending between late February and early April. The frequency and total number of fishing sets and tagging sessions varied each year depending on travel requirements, weather conditions and fish availability (Appendix A). Factors that limited the length of tagging sessions included: sea state, amount of fish in the net, predator interference and the physical condition of the fish after capture. Fish were caught by purse seine using one of three net sizes. Two nets were supplied by DFO for the purpose of catching herring in relatively shallow water and these are referred to as the small and medium sized nets, being approximately 180 m long x 17 m deep and 274 m long x 33 m deep, respectively. When fish were too deep for the DFO nets, large

commercial sized nets of approximately 274 m long x 80 m deep were deployed by other charter vessels assisting the tagging vessel crew. Fish surplus to the needs of a tagging session were released as soon as possible to reduce undue stress and mortality. If herring were caught by either the small or medium sized net, then a holding pen was made from the mesh at the net's bunt. If herring were caught by a large commercial net, then fish were dipnetted from the commercial net to a conical holding pen (approximately 2.5 m in diameter and 2.5 m deep) which was suspended by floats and transferred to the tagging vessel. Several approaches were used over the field seasons to deter predators from consuming tagged herring. Recovery pens, seal bombs and push poles were often used to try to protect fish from sea lions, seals and gulls. Spray hoses or water sprinklers were also often used to try to protect fish from gulls.

Although some aspects of the methods to tag and release herring evolved over the six field seasons, Mark IV Automatic Coded Wire Tag Injectors from Northwest Marine Technology (NMT, http://www.nmt.us/products/products.htm) were always used with 8.9 cm (3.5 inch) long tagging needles and 1.5 times standard length (1.8-2.0 mm) CWTs. Using dipnets, groups of fish (i.e. 30 to 60) were transferred from a holding pen to a tagging table supporting basins which temporarily held small groups of fish (i.e. 10-30 fish). In 1999, one of two tag insertion sites was used on each herring. Each tag was either inserted into muscle tissue located approximately 1-2 cm behind the skull (referred to as the neck or nape site) or into muscle tissue located adjacent to the base of the dorsal fin (referred to as the back or dorsal site). In all subsequent years only the neck site was used. To support fish bodies during tag insertion, the base of each tag injector needle was fitted with a cylindrical piece of brass with a smooth oblique surface (Figure 1). Tag insertion was activated using a push button electronically connected to a tag injector. In 1999, tag insertion buttons were operated by foot but for all other years tag insertion buttons were operated by knee. Knee buttons were installed so that each person applying tags could use two hands to pick a fish up from a basin and hold the fish up to the injector's needle for tag insertion. Consequently, tag insertion rates were relatively high (i.e. averaging from 650 to 1,029 fish/injector/hour) and rates generally increased each year as tagging crews and working conditions became more efficient. Different tag codes were used to differentiate tag release groups between and within tagging sessions. In 1999, fish were manually released overboard once they received a tag. For all other years, once fish were tagged they were placed into a 15 cm diameter PVC drop pipe opening extending from each tagging station. The segments of drop pipe converged under the tagging table into a main stem that was fed sea water and that used gravity to release fish overboard through a scupper.

RECOVERING TAGGED FISH FROM ROE HERRING LANDINGS

Tag recovery sampling of roe herring landings occurred in 2000 to 2006 from mid-March to mid-July when associated fish plants were processing herring caught between the end of February and early April of each year. Tag recovery sampling occurred at three Vancouver Lower Mainland fish plants (processors), which were Bella Coola Fisheries Ltd (BCF), Canadian Fishing Company Home Plant (CFC) and Delta Pacific Seafoods Ltd (DPS, formerly Icicle Seafoods Inc). At each fish plant, a tag recovery detector system was used, which consisted of an R-9500 Rectangular Tunnel Detector for detecting CWTs (Northwest Marine Technology Inc); a conveyance system with a non-metallic conveyor belt; an aluminium frame manifold; an automatic diverter gate system; and controls for setting conveyance rates, diverter responses and detector sensitivities (Figure 2).

Initial planning of tag recovery sampling involved evaluating and determining where and how to position the recovery units. The following describes operations common to the three fish plants that accommodated tag recovery units. First, freshly caught herring were offloaded from packer and seine vessel holds, then they were put into totes, brined and placed in cold storage for up to several weeks. After cold storage, totes of fish were thawed before processing to extract roe. Roe extraction involved automated machines which vertically cut fish bodies into head and tail halves to eviscerate gut contents to access roe sacs. The resulting fish body parts were conveyed to storage containers for reduction purposes. In 1999, preliminary tag recovery test trials targeted freshly caught fish conveyed from vessels during offloading. The main problems that precluded this approach were that conveyance loads during offloading ranged from 30 to 110 metric tonnes/hour, which exceeded the capacities of the recovery unit's conveyance and tag detector systems. Additionally, it would also have been logistically difficult and inefficient to staff people to oversee recovery sampling because of the unpredictable and varying dates and times of the roe herring fisheries and offloading traffic. Following further test trials in 1999 and 2000, it was determined by both DFO and fish plant staff that the best position along processing lines to search for CWTs was after roe extraction and during carcass conveyance prior to reduction. At this point in the conveyance line, speeds and loads were well suited to the operational constraints of tag recovery sampling and sampling was less likely to interfere with processing activities. Subsequently, all tag recovery sampling was done by searching carcasses destined for reduction.

Tags were no longer inserted into the dorsal tag insertion site after 1999 so that tag recoveries could be aged from otoliths. This choice was made to correspond with the processing step that cut each fish into head and tail halves, where a dorsal tag insertion site would usually be found on a tail half. It was also thought that there was greater risk of losing tags from the dorsal insertion site because the processing cut occurred near the dorsal fin. Fish scales could not be used as ageing structures because processing stages stripped them from herring bodies.

Between tag recovery years and fish plants, the number of days, search hours, quantities of roe herring searched, and number of recovery observations varied (Appendix B). Each of the three fish plants had different operating conditions, processing schedules, capacities and processed different amounts from different roe herring fisheries. Conveyance loads through the CWT detectors were fairly similar between BCF and DPS (i.e. average rates of 5.6 to 8.4 metric tonnes/hour) and loads at CFC were relatively higher (i.e. average rates of 12.5 to 20.3 metric tonnes/hour). A relatively high number of false positive recoveries were brought to the laboratory for CWT dissection in 2000 due to metal contamination. In all sampling years after 2000, to try to minimize the laboratory work associated with false positive specimens, gill and gut tissue were removed from each putative specimen and each specimen was rinsed in water before being re-tested by a metal detector. These steps proved to be cost effective by reducing the number of fish requiring dissection.

For all years, J.O. Thomas and Associates Ltd (JOT) was contracted to assist in acquiring roe herring catch validation records and tag recovery sampling information. Validation records were collected from offloading vessels and packers and tag recovery sampling information was collected during processing operations at fish plants. For tag recovery sampling, JOT staff operated tag recovery units, collected and handled recovered specimens, monitored equipment operation, verified catch information related to fish lot processing records and processing schedules, and recorded estimates of catch searched for tags by lot number, fish plant and search date. Field staff from JOT conducted recovery unit

tag detection and deflection test trials approximately every hour by dropping seeded specimens on the upstream conveyor line to a recovery unit. Results of these test trials indicate that recovery units consistently detected and deflected seeded specimens from the recovery unit's conveyor. As part of the hourly test trials, logbook records were kept of conveyance speeds, loading rates (mt/h), detector sensitivity and deflector gate settings. Records pertaining to equipment operation were not made into electronic copies and thus are not included in the database.

DATABASE TABLES, QUERIES AND FIELDS

Information related Pacific herring CWT release and recovery sampling from 1999 to 2006 is stored in 9 database tables that are formatted and saved in a Microsoft ® Access 2002 file called "HerringCWTStudy1999to2006.mdb". Four tables contain records solely corresponding to tag release sampling (named CwtSets, CwtReleases, CwtRelErrors, and CwtRepBiosampleData) and five tables contain records corresponding to tag recovery sampling or tag recovery findings (named Validation Records, Recovery Data, LabeledRecovSpecimens, Diversions and CwtSetsAndRecovLabelsReconciled). The table named "CwtSetsAndRecovLabelsReconciled" was created to address ambiguity resulting from cases when individual tag codes were applied during more than one tag release session. Users of the database must be aware that relationships between the tables do not have relational integrity.

Records in the table named "CwtSets" contain data that describe fish capture and release sampling conditions common to each purse seine set. The field "Set_ID" is a primary key that holds unique identifiers that differentiate each fishing and tagging session by sampling year and fishing set number (where set numbers started at "1" each year and were chronologically assigned). In total, this table has 36 fields and holds 173 records. Brief descriptions of the data fields associated with the "CwtSets" table are provided in Table 1.

Records in the table named "CwtReleases" contain data that describe and differentiate individual tag release sample groups (by their tag codes), which occur within and between tagging sessions. In total, this table has 14 fields and holds 774 records. Brief descriptions of the data fields associated with the "CwtReleases" table are provided in Table 2.

Records in the table named "CwtRelErrors" contain data that describe discrepancies that impede the resolution of the release source of a tag recovery because the tag code was applied during more than one tag release session. The purpose of this table is to define the cause and effect of each tag code discrepancy resulting from accidental error in tag code application. Multiple tag code application between release sessions was characterised as impeding the resolution of the relationship between the release and recovery events in one of seven ways (Appendix C). The seven types of release discrepancies are described as: between-year and different area (by da); within year and different region (wy dr); within year and different area (wy da); within year and different herring section (wy dhs); within year and different set (wy ds), and, within year and same set (wy ss). A field called "Discrep_Abbrev" holds abbreviations for the type of discrepancy describing the release and recovery relationship. Records in this table are linked to the "CwtReleases" table by the field "Error_Id". All tag codes that were assigned "wy ds" in the "Discrep_Abbrev" field were assigned an "Error _Id" of 11; thus, "Error_Id" is not a unique primary key for this table. During the initial two tagging seasons, repetitive use of a tag code in the same tag season and approximate vicinity (i.e. the same herring section or statistical area) was done to be

frugal with tagging supplies but by the third season the advantages of using unique code batches were apparent so tagging crews tried to avoid repetitive tag code applications. In total, this table has 6 fields and holds 15 records. Brief descriptions of the data fields associated with the "CwtRelErrors" table are provided in Table 3. Release sampling information associated with multiple applications of a tag code is listed in Appendix D.

Records in the table named "CwtRepBioSampleData" contain biological data from representative frozen herring samples, each of which was randomly collected from the tagging vessel's catch or from the catch of a different seine vessel fishing in close temporal and spatial proximity to the tagging session. Thus, sample data are linked to CWT data through the field "Set_Id". In total, this table has 20 fields and holds 18,277 records. Brief descriptions of the data fields associated with the "CwtRepBioSampleData" table are provided in Table 4. Sample and specimen data corresponding to CWT fishing sets are also stored in versions of the file "Herring Stock Assessment.mdb", maintained by staff at the Pacific Biological Station.

Records in the table named "Validation Records" contain data that differentiate roe herring offloading activities by offloading date, location and vessel and by the fishery product being offloaded (by fishing date, gear type and location). The field "Lot Number" is a primary key that holds unique identifiers that differentiate each offloading event by offloading date, offloading site, packer vessel, fishing vessel, fishing date and fishing gear. Most of the "Lot Number" codes were constructed by JOT staff by combining the offloading year with the coding used by industry. In total, this table has 19 fields and holds 4,170 records. Brief descriptions of the data fields associated with the "Validation Records" table are provided in Table 5.

Records in the table named "Recovery Data" contain data that describe samples of roe herring product searched to recover tagged fish. The field "Sample" is a primary key that holds unique identifiers that differentiate each sample of product searched for tags by date, processor, catch lot (by "Lot Number") and estimated weight amount ("Est Chk"). But, if database users query the tables "Recovery Data" and "Validation Records" to compare each sample's estimated weight with its corresponding catch lot's weight, they will find that some sample weights appear greater. In theory, this should be impossible but the weight discrepancies result from the fact that each of the fish plants often processed fish from the same fishery but from different catch lots back to back while running multiple (from 3 to 10) automated roe extraction machines simultaneously. The sequences in which the product (by catch lot) were fed to the roe extraction machines often allowed incidental mixing of product on a converging conveyor belt positioned after the roe extraction process but upstream of a tag recovery unit. Consequently, estimates of amounts searched for tags ("Est Chk") by lot number are not always accurate but weight estimates for a given sampling day, fish plant and fishery should be. In total, this table has 8 fields and holds 2,485 records. Brief descriptions of the data fields associated with the "Recovery Data" table are provided in Table 6.

Records in the table named "LabelRecovSpecimens" contain data that describe specimens collected through tag recovery events. The field "Label" is a primary key that holds unique identifiers that differentiate each specimen by tag recovery "Sample", tag code, otolith and other information. Records in this table describe 8,756 specimens recovered with known tag codes, 1,311 specimens with metal particle contamination resulting in false recoveries and 24 cases where CWTs were accidentally lost in the laboratory prior to being read. In total, this table has 10 fields and holds 10,091 records. Brief descriptions of the data fields associated with the "LabelRecovSpecimen table are provided in Table 7.

Records in the table named "CwtSetsAndRecovLabelsReconciled" also contain data that relate to specimens collected through tag recovery events, but in this table, specimen identifiers (by "Label") are reconciled to the first (or in most cases the only) tagging session that a relevant tag code was applied. The purpose of this table is to facilitate additional table linkages (i.e. sqLabelCwtSet) by reducing ambiguity from tag code release discrepancies. Thus, the field "Label" is again used as a primary key that holds unique identifiers that differentiate each tag recovery specimen. Therefore, database users interpreting subsequent output using this table should be aware of the "First_Set_ID" assignment and become familiar with the cause and effect of each release discrepancy (from linking tables to the "CwtRelErrors" table by the "Error_Id" field). In total, this table has 3 fields and holds 10,091 records. Brief descriptions of the data fields associated with the "CwtSetsAndRecovLabelsReconciled" table are provided in Table 8. All discrepant tag codes are listed in Appendix D.

Records in the table named "Diversions" contain data for the number of fish diverted from a recovery unit's conveyor belt by the diverter gate each time a unit was tripped by a CWT or another metal signal. In total, this table has 2 fields ("Sample" and "Number Diverted"), neither of which are primary keys, and holds 18,768 records. Brief descriptions of the data fields associated with the "Diversions" table are provided in Table 9.

In addition to the 9 tables of records, 8 queries were constructed in the Microsoft ® Access file "HerringCWTStudy1999to2006.mdb" to assist database users in accessing and summarizing sets of data. Five of these queries relate to specimen records from tag recovery sampling, these are named sqCwtSet, sqLabelCwtSet, qLabelSummaryCwt, qLabelSummaryDiscrepCwt and qLabelSummaryNonCwt. The first two are sub-queries that link all release sampling information to reconciled tag recovery specimen records. The third query qLabelSummaryCwt contains the 8,756 records related to CWT recaptures and most database users will probably modify this query to access data sets for their research needs (Figure 3). However, output from this query includes tag recovery specimen records for which the exact release event cannot be discerned due to ambiguity resulting from multiple application of tag codes during multiple release sessions (refer to Appendix C). Both queries qLabelSummaryCwt and qLabelSummaryDiscrepCwt identify the first tag release session (by Set_ID) that each tag code sample was used and both queries provide information from the table CwtRelErrors to explain the cause and type of each release discrepancy. The query qLabelSummaryNonCwt contains 1,335 records for the 1,311 specimens collected with metal particle contamination and the 24 specimens from which CWTs were lost prior to having their code read. Three other queries generate output summarizing roe herring catch information and tag recovery sampling intensity. The names of these queries are: qCatchWeightEstSample, qCatchWeightHarvest and qCatchWeightHarvestAndSample. The first query resolves total amounts of catch sampled by recovery year, statistical area and fishing gear; the second query resolves total amounts of catch harvested by fishing year, statistical area and fishing gear and the third query matches records from these two queries (Figure 4).

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Table 1. Field descriptions for the data table "CwtSets".

Field Name	Data Type	Description
Set_ID	Text	Unique record identifier. Year and fishing set number of tag release event (i.e. YYY-SSS).
Set	Number	Fishing set number ordered chronologically each year.
Rel_Date	Date	Date of fishing and tagging (i.e. DD/MM/YYYY).
Rel_Y	Number	Year of fishing and tag release (i.e. YYYY).
Rel_M	Number	Month of fishing and tag release (i.e. MM).
Rel_D	Number	Day of month of fishing and tag release (i.e. DD).
Rel_SAR	Text	Assigned Herring Stock Assessment Region of release.
Rel_StatArea	Text	Fisheries Management Statistical Area of release (3 digit format).
Rel_Sub_Stat	Text	Fisheries Management Sub-Area of release.
Rel_Sec	Text	Designated Herring Section of release.
Rel_Location	Text	Name of geographical reference location near or at release site.
Rel_LatD	Number	Latitudinal coordinates (degrees).
Rel_LatM	Number	Latitudinal coordinates (minutes).
Rel_LonD	Number	Longitudinal coordinates (degrees).
Rel_LonM	Number	Longitudinal coordinates (minutes).
PST	Time	Pacific standard time (approximate time when seine net was pursed.)
Hrs	Number	Duration of tagging session (hours).
Intervals	Number	Total number of intervals in tagging session.
Taggers	Number	The number of tag injectors in operation.
Marine_Conditions	Text	Brief description of wind and sea state.
WindSpeed	Text	Estimate of average wind speed and direction.
Spawning_Activity	Text	Notes on nearby spawning if observed or known.
Fishery_Status	Text	Notes on relative location and time of proximal fishing activity.
Predation	Text	Notes on observed predator behaviour or sightings near tagging vessel.
Pen	Text	Indicates whether or not a holding pen was used after tag insertion.
PrHose	Text	Indicates whether or not a deck hose was used to deter predators from release out pipe.
Sprinkler	Text	Indicates whether or not an industrial garden sprinkler was used to deter predators from release out pipe.
NetSize	Text	Indicates relative size of purse seine net used to catch fish (i.e. small, medium or large).
Fishing_vessel	Text	Name of vessel that caught fish for tagging.
SetProbs	Text	Notes on delays (i.e. roll ups, too large of catch, bottom snags etc) in the net prior to tagging.
PreTagTime	Text	Time between when seine net was pursed and first fish was tagged in tagging set.
BioSample_y_n	Text	Indicates whether or not a representative biological sample of fish was taken from the tagging set.
SetLog_ y_n	Text	Indicates whether or not a set log sample form was completed for in-season observations.
DNA_y_n	Text	Indicates whether or not a sample of fish tissue was collected for DNA analysis.
SOK Area & Days	Text	Notes on spawn on kelp activity in area if known.
RelComments	Text	Miscellaneous field notes.

Table 2. Field descriptions for the data table "CwtReleases".

Field Name	Data Type	Description
ID	AutoNumber	Unique record identifier
Set_ID	Text	Tag release year and fishing set number (i.e. YYYY-SSS)
Base_Code	Text	CWT code in the format of ##-##-## (i.e. Three two digit numbers separated by two hyphens)
Tag_Type	Text	Binary batch (Bi), decimal batch (Dec), decimal sequential (DecSq) or binary sequential (BiSq).
FrSeq	Number	Start of sequence for a batch of sequential tags.
ToSeq	Number	End of sequence for a batch of sequential tags.
Error_Id	Number	Applies to release groups with code discrepancies only. See description of table "CwtRelErrors"
CWTs_per_code	Number	The batch size of tagged herring released in a tag session or tag release interval.
Tag_Use	Number	The cumulative number of times that the Base_Code was used for the current record.
Interval	Number	The tag release batch interval within a tagging session from an individual set (i.e. 1 to 4). All intervals were 45-60 minutes in length.
Interval_rating	Text	Coding from A to F used to try to describe relative levels of physical stress endured by fish from fishing and fish handling. A coding of "A" suggests that a batch of fish expressed minimal stress responses (i.e. freshly caught without any physical or behavioural signs of trauma). Conversely, a coding of "F" suggests that a batch of fish tagged fish expressed relatively high levels of stress responses, such as scale loss or reduced physical strength, from relatively long holding periods, fishing complications or impacts from sea surface.
Body_Site	Text	Location in fish body where CWT was inserted, neck (central dorsal nape region posterior of skull) or back (central dorsal region anterior of dorsal fin).
Anaes	Text	Indicates whether an anaesthetic (i.e. ms222 or clove oil) was used.
Comments	Text	Miscellaneous information (i.e. database updates.)

Table 3. Field descriptions for the data table "CwtRelErrors".

Field Name	Data Type	Description
Error_Id	Number	Assigned number (from 1 to 15) that relates to "CwtReleases" table records.
Discrep_Abbrev	Text	Abbreviation (acronym) describing type of discrepancy.
Correct_Code_rel	Text	Correct CWT code for a release event
Discrep_Code_rel	Text	Initial error in CWT reporting for a release event.
Disc_Code_Defn	Text	Defines acronym used in Discrep Abbrev.
Er_Comments	Memo	Explicit description of cause of code discrepancy.

Table 4. Field descriptions for the data table "CwtRepBioSampleData".

Field Name	Data Type	Description
ID	AutoNumber	Unique record identifier (for CWT table only).
Set_Id	Text	Tag release year and fishing set number of tag release event associated with biological sample record.
BioSample	Number	Assigned number used to keep inventory of samples in "Herring Stock Assessment.mdb" database records.
SourceSamp	Number	Permitted access to sample collection through inshore research survey(2), test fishery (5) or other (4) .
GearSamp	Number	Fishing gear used to collect sample (21 and 29 are both purse seine).
Year	Number	Year that biological sample was collected (i.e. YYYY).
Season	Number	Code used to reference stock assessment year (July 1 to June 30th) for Herring Stock Assessment database records.
MonthSamp	Number	Month that biological sample was collected (i.e. MM).
DaySamp	Number	Day of month that biological sample was collected (i.e. DD).
StatSamp	Text	Fisheries Management Statistical Area that biological sample was collected from.
SecSamp	Text	Geographical Herring Section that biological sample was collected from.
BioLocation	Text	Name of geographical reference location near or at release site.
Fish#	Number	Individual specimen number per BioSample.
Length	Number	Standard length measurement of individual fish (mm).
Weight	Number	Total weight measurement of individual fish (g).
Sex	Text	Sex of specimen (1= male, 2= female, 3= unknown).
Maturity	Number	Maturity rating of gonads.
Gonad Length	Number	Length of individual gonad (mm).
Gonad Weight	Number	Total weight of gonads (g)
BioAge	Number	Age (year of life) of fish from reading scale annuli.

Table 5. Field descriptions for the data table "Validation Records".

Field Name	Data Type	Description
Lot Number	Text	Catch lot number unique to recovery year, roe fishery, offloading vessel and processing fish plant.
RecovYear	Number	Year of roe herring fishing.
Stat Area	Text	Fisheries Management Statistical Area of recapture (3 digit format)
Gear	Text	Roe herring fishing gear used.
Fishery Name	Text	Roe herring fishing region and gear type. Charter fishery noted where applicable.
RecLocation	Text	Name of geographical reference location near or at where roe herring catch obtained.
CatchStartDate	Date	First day that fish on packer vessel were caught.
CatchEndDate	Date	Last day that fish on packer vessel were caught.
Catcher Vessel	Text	Name of catch vessel (seine) or gillnet pool.
Packer Vessel	Text	Name of packing vessel offloading during validation.
Pool ID	Number	Roe herring fishing pool code.
Tons	Number	Validated weight in short tons.
Weight (lbs)	Number	Validated weight in pounds.
Validator	Text	Name of person validating catch.
Coordinator	Text	Name of person coordinating catch validation.
Cmpy Code	Text	Offloading plant company code.
Offload Date	Date	Date of offloading and validation records made.
Offload Plant	Text	Fish plant where catch from offloading vessel was validated.
Comment	Text	Miscellaneous notes on catch validation.

Table 6. Field descriptions for the data table "Recovery Data".

Field Name	Data Type	Description
Sample	AutoNumber	A primary key field referencing a specific amount and source of roe herring catch searched for tag recovery sampling.
Lot Number	Text	The catch lot number (code) unique to recovery year, roe fishery, offloading vessel and processing fish plant.
Process Date	Date	The date of tag recovery catch sampling.
Processor	Text	The fish plant of tag recovery.
Shift Type	Number	The fish plant operating shift. (1= day, 2= evening).
Est Chk	Number	The estimated amount (in short tons) of round roe herring searched by the tag recovery equipment.
Tech	Text	The initials of technician operating tag recovery equipment.
Stat Week	Text	The week number (i.e. Julian calendar).

Table 7. Field descriptions for the data table "LabelRecovSpecimens".

Field Name	Data Type	Description
Label	Number	Unique six digit numerical identifier for each tag recovery specimen (primary key).
Sample	Number	The sample number referencing a specific source of roe herring catch searched for tags.
Base_Code	Text	CWT code in the format of ##-##-## (i.e. Three two digit numbers separated by two hyphens)
Data3	Number	Part of referencing system developed by NMT to decode binary sequential tag codes to identify release batch.
Data4	Number	Part of referencing system developed by NMT to decode binary sequential tag codes to identify release batch.
Sequential	Number	For sequential tag types only. Specific tag code sequence number to identify release batch.
RecAge	Number	Age (year of life) of fish from reading otolith annuli.
Otolith Tray	Number	Tray number (by recovery year).
Otolith Cell	Number	Otolith tray cell number.
Comment	Text	Notes on tag recovery specimen observations.

Table 8. Field descriptions for the data table "CwtSetsAndRecovLabelsReconciled".

Field Name	Data Type	Description
Label	Number	Unique tag recovery specimen record identifier.
First_Set_ID	Text	Denotes the unique tag release fishing set corresponding to a tag code or, denotes the first tag release fishing set corresponding to a tag code that was used for multiple release events.
Base_Code	Text	CWT code in the format of ##-##-## (i.e. Three two digit numbers separated by two hyphens)

Table 9. Field descriptions for the data table "Diversions".

Field Name	Data Type	Description
Sample	Number	A sample number referencing a specific source of roe herring catch searched for tags, which corresponds to a "Sample" record in the table "Recovery Data".
Number Diverted	Number	The number of herring pieces (halves) diverted off a tag recovery unit conveyor belt and requiring manual tag detection to collect the specimen triggering the recovery equipment.

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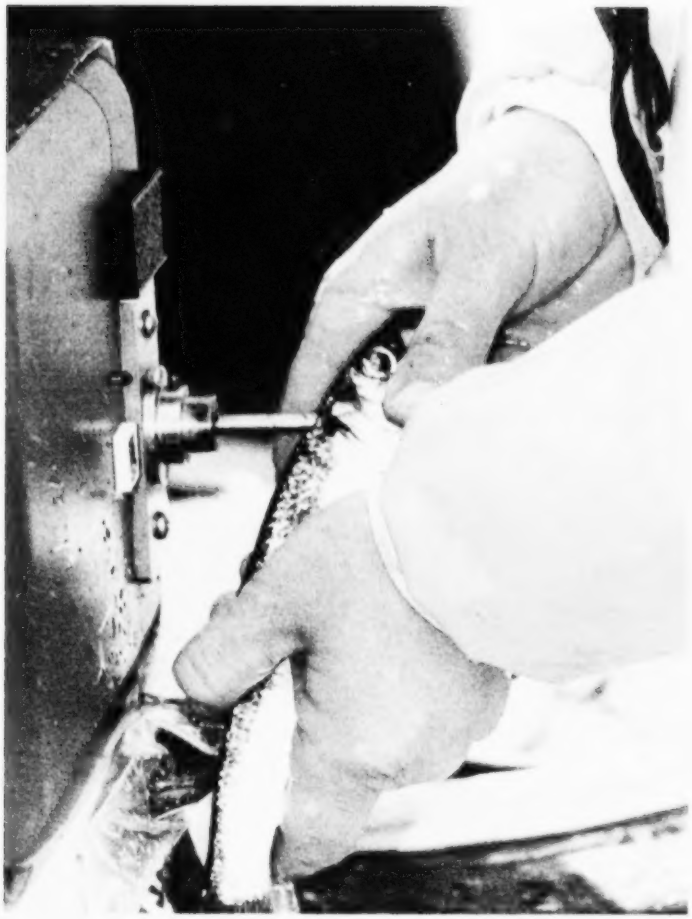
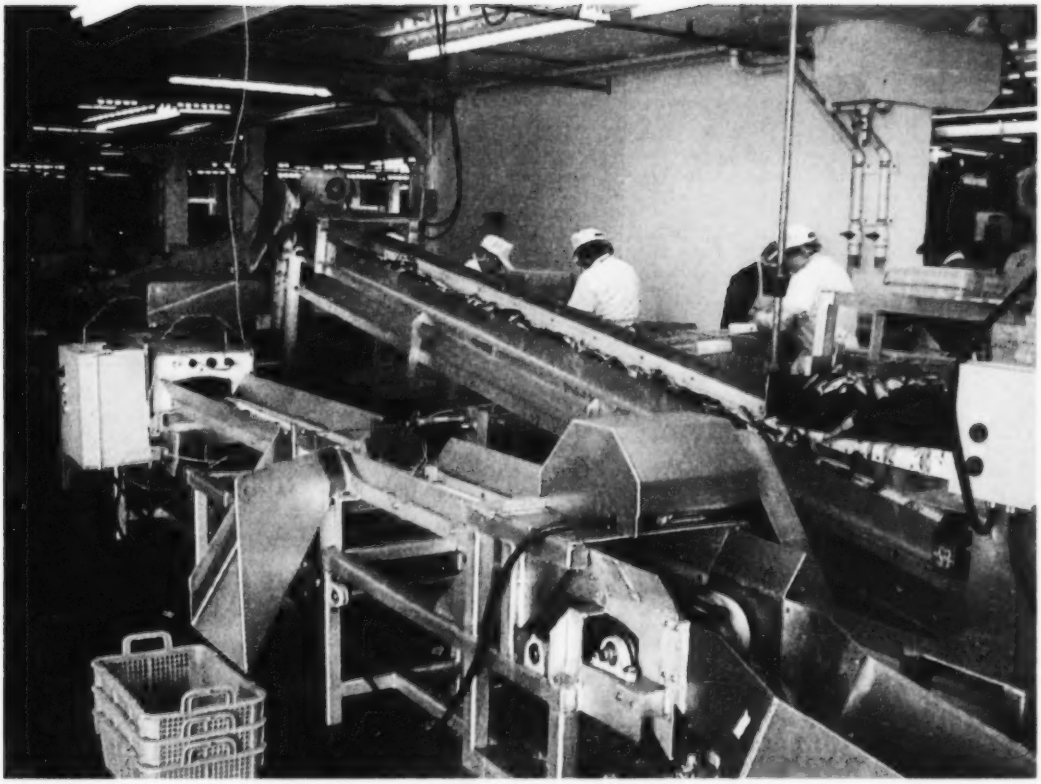


Figure 1. Photograph showing coded wire tag insertion into the nape site of a Pacific herring using a cylindrical brass needle support fixed to a Northwest Marine Technology ™ Mark IV Automatic Tag Injector.



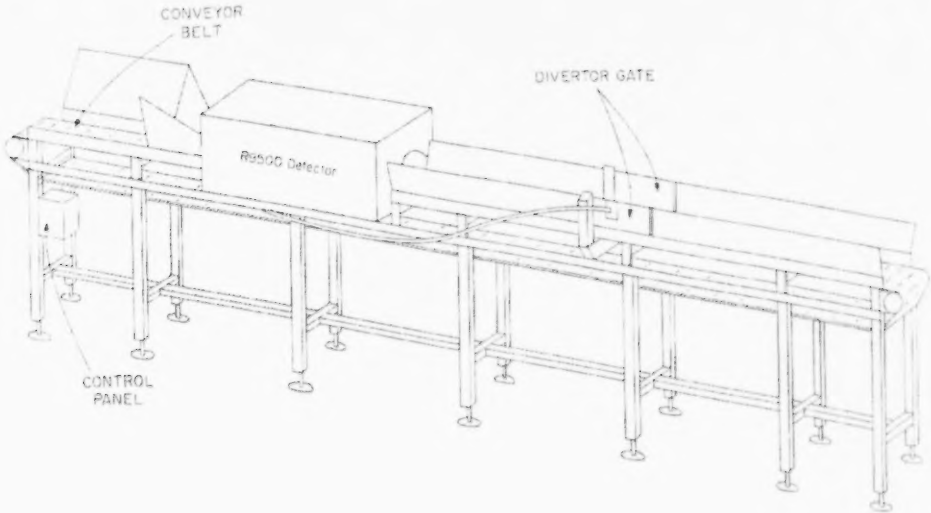


Figure 2. Photograph and diagram showing components of a coded wire tag recovery unit.

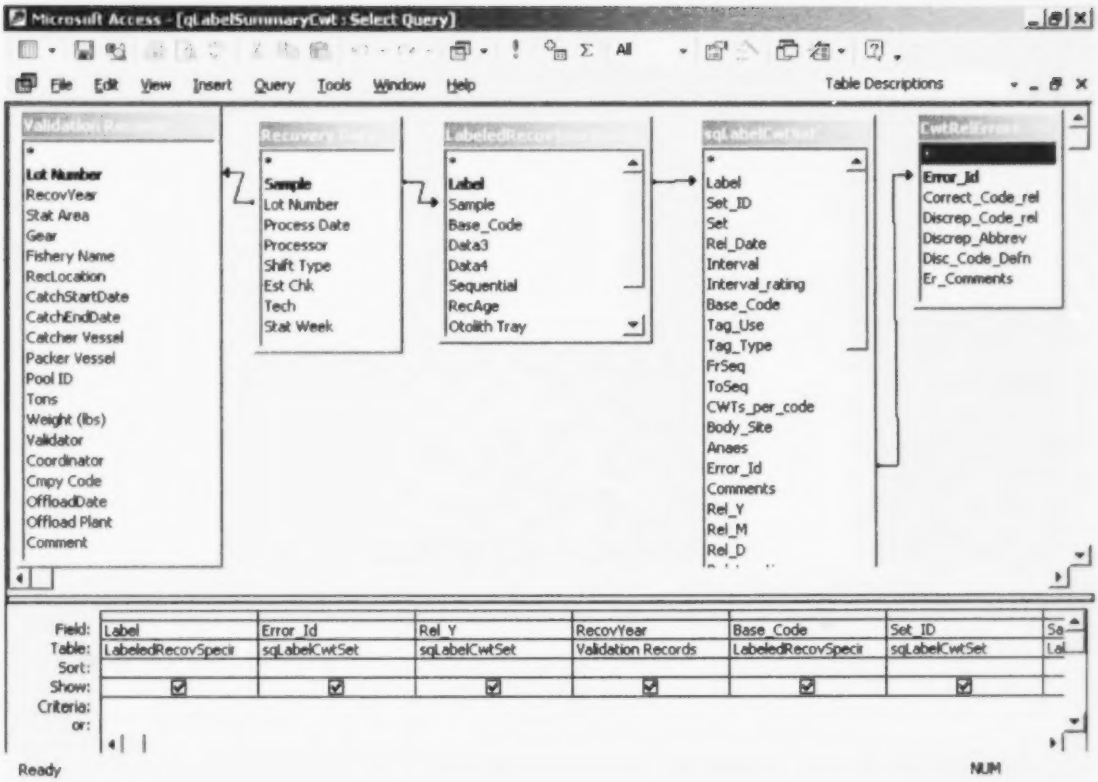


Figure 3. Query relationships generating "qLabelSummaryCwt" output. Output from this query holds 8,756 records specific to tag recovery specimens collected from tag recovery equipment at the fish plants and reconciled to the first tagging release set for the respective tag code.

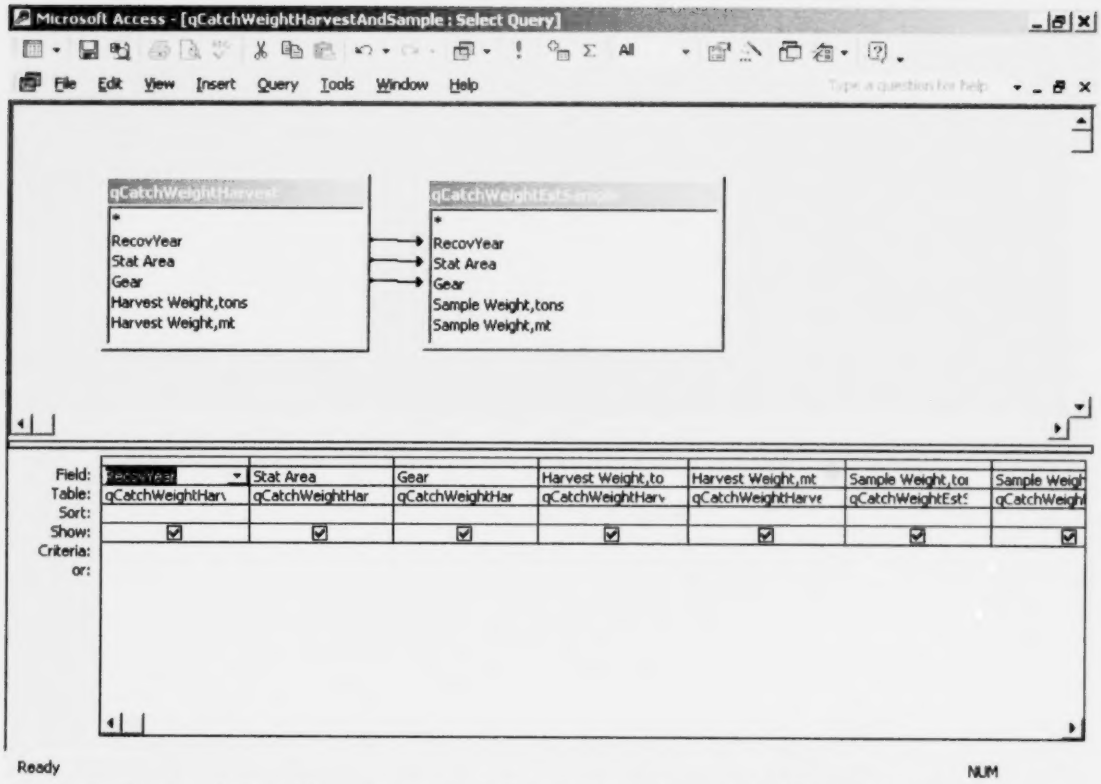


Figure 4. Query relationships generating "qCatchWeightHarvestAndSample" output. Output from this query holds 70 records summarizing total catch and sample amounts by year, location and gear type of each roe herring fishery.

APPENDIX A. The number of vessel and tagging days, fishing sets, tag injectors (Injs), tagging rates and release sampling intensities (average, minimum and maximum) summarized by year.

Year	Vessel days	Tag days	Sets	Injs	Set duration (h)			Tag rate (T/ inj/ h)			Releases per set			Releases
					Ave	Min	Max	Ave	Min	Max	Ave	Min	Max	
1999	30	14	19	2	2.7	0.8	4.5	53,887	143	1,876	2,836	675	4,422	53,887
2000	30	19	32	4	2.2	0.5	3.3	248,391	471	1,421	7,762	2,307	11,695	248,391
2001	30	16	36	3	1.7	0.2	2.6	148,754	280	1,491	4,132	168	7,443	148,754
2002	30	20	34	4	2.0	0.5	3.0	227,928	187	2,586	6,704	1,771	11,081	227,928
2003	30	16	28	4	2.9	0.3	4.0	328,423	834	1,422	11,729	1,203	16,394	328,423
2004	30	18	24	4	3.6	1.5	4.5	357,346	678	1,228	14,889	5,424	21,627	357,346
All														1,364,729

APPENDIX B. Tag recovery sampling efforts summarized by year and fish plant, including: the number of days; the number of staffed shifts; the number of operating hours; an estimate of the total catch amount searched; the average conveyance rate of tag recovery unit (metric tonnes/hour); the number of tagged specimens recovered (Lab CWTs); the number of false positive specimens observed after dissection (Lab FP); the number of false positive specimens observed in the fish plants (Non Lab FP); the number of diverter gate responses (Est Div) and an estimate of the total number of fish diverted (Est Fish Diverted).

Year	Plant	Days	Shifts	Est Hrs	C (mt)	Ave (mt/hr)	Lab CWTs	Lab FP	Non Lab FP	Est Div	Est Fish Diverted
2000	CFC	25	25	137.5	2,366.9	20.3	205	297	NR	NR	NR
	ICI	51	101	528.5	3,330.3	7.8	325	298	NR	NR	NR
2001	BCF	38	38	247	1,887.0	8.4	207	56	836	892	33,908
	CFC	28	28	154	2,561.9	17.5	168	28	293	321	19,785
	ICI	44	81	430.5	2,397.7	6.5	203	66	702	768	19,020
2002	BCF	50	52	335	2,452.2	7.3	721	60	1,146	1,206	49,146
	CFC	37	37	203.5	3,150.7	16.1	952	46	830	876	43,300
	ICI	44	84	444.5	2,855.9	6.5	924	96	1,270	1,366	40,405
2003	BCF	57	67	385.5	2,358.7	6.1	609	21	951	972	34,675
	CFC	25	31	137.5	2,236.3	16.5	261	12	271	283	13,039
	ICI	46	94	458.5	2,548.3	5.6	278	96	1,016	1,112	27,237
2004	BCF	47	54	340.5	2,103.8	6.2	609	15	791	806	30,308
	CFC	25	25	137.5	1,805.3	13.1	315	23	416	439	20,411
	ICI	33	65	343	2,197.2	6.5	328	39	893	932	24,205
2005	BCF	51	69	417	2,542.0	6.8	588	28	798	826	30,070
	CFC	37	38	222	2,761.5	12.5	988	48	639	687	32,446
	ICI	42	66	378	2,148.3	5.7	525	21	510	531	15,023
2006	BCF	40	70	525	2,596.4	7.0	298	35	NR	1,116	25,431
	CFC	36	36	216	1,948.7	12.0	98	24	NR	582	18,612
	DPS	39	39	308	1,525.9	6.0	150	23	NR	411	7,281
ALL	ALL	795	1,099	6,349	47,775.0	8.4	8,757	1,332	11,362	14,126	484,302

APPENDIX C. Contents of data table "CwtRelErrors"

Error_Id	Discrep_Abbrev	Disc_Code_Defn	Discrep_Code_rel	Correct_Code_rel	Er_Comments
1	by da	between year different (stat) area	18-08-48	18-08-48	Tag code 18-08-48 was used in 1999-001 (Section 142) and 2000-030 (Section 172)
2	by da	between year different (stat) area	18-15-63	18-15-63	Tag code 18-15-63 was used in 1999-003 (Section 142); 2000-023 and 2000-024 (Section 173)
3	wy dr	within year different region	18-45-39	18-45-39	Tag code 18-45-39 was used in 2004-009 (Section 253) and 2004-012 (Section 085)
4	wy da	within year different (stat) area	18-12-13	18-12-32	A spool labelled 18-12-13 was in fact 18-12-32; 1999-012 (Section 173); 1999-013 (Section 143)
5	wy da*	within year different (stat) area; *but all 2000 recovs from Stat 14 set 2000-005	02-13-12	18-14-43	A spool labelled 02-13-12 was in fact 18-14-43; 2000-005 (Section 142); 2000-025 (Section 173)
6	wy dhs	within year different herring section	18-03-34	18-42-17	A spool labelled 18-03-34 was in fact 18-42-17; 2000-011(Section 142); 2000-016 & 2000-017(Section 143)
7	wy dhs	within year different herring section	18-32-42	18-32-42	Tag code 18-32-42 was used in 2000-026 with ms222 (Section 173) and 2000-027 no ms222 (Section 172)
8	wy dhs	within year different herring section	18-32-59	18-32-59	Tag code 18-32-59 was used in 2003-004 (Section 143) and 2003-007 (Section 142)
9	wy dhs	within year different herring section	18-45-61	18-45-61	Tag code 18-45-61 was used in 2003-015 (Section 076) and 2003-016 (Section 074)
10	wy dhs	within year different herring section	18-46-28	18-46-28	Tag code 18-46-28 was used in 2003-015 (Scetion 076) and 2003-016 (Section 074)
11	wy shs	within year same herring section and (stat) area but different set	Various	Various	Various tag codes (49 dif codes in total) from 1999 -2002 used in more than one set but each code used in same herring section
12	wy ds	within year different set (same herring section)	18-12-19	02-12-12	A spool labelled 18-12-19 was in fact 02-12-12; 2000-014; 2000-015; 2000-021(all Section 143)
13	wy ss	within year same set	18-34-42	18-42-23	A spool labelled 18-34-42 was in fact 18-42-23; both used 2000-019 (Section 142)
14	wy ss	within year same set	18-34-35	18-34-45	A spool labelled 18-34-35 was in fact 18-34-45; both used 2000-013 (Section 143)
15	wy ss	within year same set	18-31-11	18-31-10	A spool labelled 18-31-11 was in fact 18-31-10; both used 2000-027 (Section 172)

APPENDIX D. Release and recovery details of within-year and between-year tag code discrepancies.

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
1	by da	1999	18-08-48	14	142	1	2,587	*(8)	5	8	1	0	0	0
		2000	18-08-48	17	172	30	952							
2	by da	1999	18-15-63	14	142	3	1,857	*(4)	10	6	5	1	0	0
		2000	18-15-63	17	173	23, 24	1,745							
3	wy dr	2004	18-45-39	25	253	9	2,833	0	0	0	0	0	1	0
			18-45-39	8	085	12	426							
4	wy da	1999	18-12-13	14	143	13	3,310	7	13	6	1	0	0	0
			18-12-32	17	173	12	2,505	3	0	1	0	1	0	0
5	wy da	2000	02-13-12	14	142	5	3,017	0	0	0	0	0	0	0
			18-14-43	17	173	25	3,454	7	8	9	1	4	0	0
6	wy dhs	2000	18-03-34	14	142	11	6,356	0	8	12	1	0	0	0
			18-42-17	14	143	16, 17	7,030	0	8	16	5	0	0	0
7	wy dhs	2000	18-32-42	17	173	26	424	0	1	0	0	0	0	0
			18-32-42	17	172	27	141							
8	wy dhs	2003	18-32-59	14	143	4	1,102	0	0	0	0	1	0	0
			18-32-59	14	142	7	861							
9	wy dhs	2003	18-45-61	7	076	15	868	0	0	0	0	11	1	1
			18-45-61	7	074	16	1,121							
10	wy dhs	2003	18-46-28	7	076	15	1,045	0	0	0	0	5	3	0
			18-46-28	7	074	16	336							

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
11	wy ds	2000	02-16-57	14	143	4	4,171	89	5	6	1	1	0	0
			02-16-57	14	143	12	5,026							
11	wy ds	2000	02-18-63	14	142	7	363	2	5	4	3	0	1	0
			02-18-63	14	142	8	2,539							
			02-18-63	14	142	9	1,961							
			02-18-63	14	142	10	1,553							
11	wy ds	2000	02-22-21	14	142	7	1,814	11	4	8	1	0	0	1
			02-22-21	14	142	8	3,156							
			02-22-21	14	142	9	1,794							
11	wy ds	2000	02-28-06	14	143	14	1,142	0	4	4	2	2	0	0
			02-28-06	14	143	15	768							
11	wy ds	2000	02-48-43	14	143	14	2,038	0	11	10	0	1	0	1
			02-48-43	14	143	15	687							
11	wy ds	2000	08-16-06	14	142	9	3,633	0	42	23	3	2	0	0
			08-16-06	14	142	10	10,142							
			08-16-06	14	142	11	2,325							
11	wy ds	2000	08-16-10	14	142	1	4,705	147	22	38	9	2	2	0
			08-16-10	14	142	2	10,125							
			08-16-10	14	142	3	4,133							
11	wy ds	2000	08-24-47	14	142	6	558	3	5	7	0	0	0	0
			08-24-47	14	142	7	1,991							
			08-24-47	14	142	8	2,396							
11	wy ds	2000	08-26-31R	14	142	6	393	4	11	5	2	2	0	0
			08-26-31R	14	142	7	1,760							
			08-26-31R	14	142	8	2,549							
			08-26-31R	14	142	9	941							

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
11	wy ds	2000	12-19-50	14	142	3	4,418	40	15	20	7	1	0	0
			12-19-50	14	142	5	5,038							
			12-19-50	14	142	6	2,582							
			12-19-50	14	142	7	1,434							
11	wy ds	2000	12-22-45	14	142	5	2,368	6	3	7	0	0	1	0
			12-22-45	14	142	6	2,441							
11	wy ds	2000	18-03-47	17	173	23	592	0	2	7	0	0	0	0
			18-03-47	17	173	24	1,695							
11	wy ds	2000	18-04-35	14	143	14	1,664	0	12	3	1	1	0	0
			18-04-35	14	143	15	466							
11	wy ds	2000	18-12-41	17	173	23	551	0	3	1	2	1	0	0
			18-12-41	17	173	24	1,385							
11	wy ds	2000	18-15-59	14	143	16	1,586	0	4	0	2	0	0	0
			18-15-59	14	143	17	523							
11	wy ds	2000	18-34-47	17	173	23	411	0	3	3	2	0	0	0
			18-34-47	17	173	24	1,017							
11	wy ds	2000	18-37-28	17	172	29	839	0	3	1	0	0	0	0
			18-37-28	17	172	30	1,907							
11	wy ds	2001	02-02-61R	14	143	16	1,561	0	0	2	3	1	0	0
			02-02-61R	14	143	17	301							
11	wy ds	2001	02-02-62R	5	052	19	626	0	1	3	7	2	0	0
			02-02-62R	5	052	20	1,320							

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s),	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
11	wy ds	2001	02-05-24	5	052	18	176	0	0	6	3	3	2	0
			02-05-24	5	052	19	1,244							
			02-05-24	5	052	20	993							
11	wy ds	2001	02-10-47	5	052	21	1,597	0	0	7	3	1	1	1
			02-10-47	5	052	22	994							
11	wy ds	2001	02-12-63	14	142	6	1,636	0	3	12	2	1	3	0
			02-12-63	14	142	7	381							
			02-12-63	14	142	8	906							
11	wy ds	2001	02-30-12	4	42	33	836	0	1	5	2	8	6	5
			02-30-12	4	042	34	2,895							
			02-30-12	4	042	35	1,646							
			02-30-12	4	042	36	357							
11	wy ds	2001	02-36-09	4	042	35	1,536	0	0	1	1	1	0	0
			02-36-09	4	042	36	434							
11	wy ds	2001	02-41-28	5	052	21	2,036	0	0	11	6	6	3	0
			02-41-28	5	052	22	1,220							
11	wy ds	2001	02-41-31	5	052	21	1,393	0	0	4	3	3	4	0
			02-41-31	5	052	22	1,035							
11	wy ds	2001	02-44-58	14	143	3	1,107	0	1	1	1	2	1	0
			02-44-58	14	143	4	287							
11	wy ds	2001	02-50-50	5	052	18	633	0	1	2	4	3	2	0
			02-50-50	5	052	19	2,048							
11	wy ds	2001	02-63-20	14	143	1	1,088	0	1	34	5	4	4	0
			02-63-20	14	143	2	5,446							
			02-63-20	14	143	3	1,923							

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
11	wy ds	2001	08-24-40	4	42	31	1,915	0	0	1	1	3	3	0
			08-24-40	4	42	32	1,719							
11	wy ds	2001	08-24-41	14	142	7	1,782	0	6	8	4	1	0	0
			08-24-41	14	142	8	688							
11	wy ds	2001	08-24-61	4	42	31	2,160	0	1	8	4	2	4	2
			08-24-61	4	42	32	2,213							
11	wy ds	2001	08-24-62	4	42	31	2,306	0	2	12	1	5	4	2
			08-24-62	4	42	32	2,195							
11	wy ds	2001	18-01-40	14	142	5	2,084	0	10	11	4	2	4	0
			18-01-40	14	142	8	490							
11	wy ds	2001	18-07-38	14	143	12	1,354	0	8	7	5	2	1	1
			18-07-38	14	143	13	2,287							
			18-07-38	14	143	14	52							
			18-07-38	14	143	15	1,077							
11	wy ds	2001	18-08-45	14	142	5	1,734	0	7	11	4	1	0	0
			18-08-45	14	142	8	341							
11	wy ds	2001	18-09-37	14	143	3	1,497	0	2	4	3	0	2	0
			18-09-37	14	143	4	826							
11	wy ds	2001	18-16-54	14	143	12	716	0	1	6	2	3	0	1
			18-16-54	14	143	13	1,718							
11	wy ds	2001	18-19-45	14	142	9	544	0	3	8	3	2	1	0
			18-19-45	14	142	10	1,757							
			18-19-45	14	142	11	1,092							

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
11	wy ds	2001	18-21-23	14	142	6	1,611	0	4	10	2	1	1	3
			18-21-23	14	142	7	381							
			18-21-23	14	142	8	356							
11	wy ds	2001	18-22-60	14	142	9	345	0	2	20	4	2	1	1
			18-22-60	14	142	10	1,461							
			18-22-60	14	142	11	837							
11	wy ds	2001	18-28-31	14	142	7	2,877	0	13	11	2	0	1	0
			18-28-31	14	142	8	1,139							
11	wy ds	2001	18-34-16	5	52	18	423	0	1	3	1	2	0	0
			18-34-16	5	52	19	797							
11	wy ds	2001	18-34-46	14	143	13	985	0	1	8	1	1	1	1
			18-34-46	14	143	14	116							
			18-34-46	14	143	15	1,697							
11	wy ds	2001	18-38-47	4	42	33	370	0	3	4	2	1	2	1
			18-38-47	4	42	34	1,455							
			18-38-47	4	42	35	1,280							
11	wy ds	2001	18-39-02	14	142	9	451	0	2	13	8	2	0	0
			18-39-02	14	142	10	1,675							
			18-39-02	14	142	11	940							
11	wy ds	2001	18-39-10	14	142	6	2,286	0	7	15	6	4	1	0
			18-39-10	14	142	7	533							
12	wy ds	2000	18-12-19	14	143	14, 15	2,506	0	7	0	0	0	0	0
			02-12-12	14	143	21	9,108	0	16	14	4	0	0	0
13	wy ss	2000	18-34-42	14	142	19	511	0	0	0	0	0	0	0
			18-42-23	14	142	19	0	0	0	0	0	0	0	0

Appendix D (continued).

Error_Id	Discrep_ Abbrev	Release Year	Tag Code	Stat. Area	Herring Section	Set(s)	CWTs	Recoveries by recovery year						
								2000	2001	2002	2003	2004	2005	2006
14	wy ss	2000	18-34-35	14	143	13	2,024	0	0	0	0	0	0	0
			18-34-45	14	143	13	0	0	6	3	1	0	0	0
15	wy ss	2000	18-31-11	17	172	27	3,312	0	0	2	1	0	0	0
			18-31-10	17	172	27	3,060	0	7	2	1	0	0	0

*(by da recoveries collected in 2000 do not have ambiguous release events because both tag codes were used on releases after the Strait of Georgia roe fisheries in 2000, thus could not have contributed to recoveries made in that year.)